

Indian Ocean echinoderms collected during the *Sindbad Voyage* (1980–81): 2. Asteroidea

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SYNOPSIS. Fifteen species of shallow-water Asteroidea, representing nine genera in four families, are recorded from collections made during the *Sindbad Voyage* (Oman to China) from the Lakshadweep (Laccadive) Islands, Sri Lanka and Pula Wé (Sumatra).

Paraferdina laccadivensis James 1973 is re-described and a new species (*P. sohariae*) is described. Range extensions are recorded for *P. laccadivensis*, *Fromia nodosa* and *Thromidia seychellesensis*.

INTRODUCTION

The coral reef asteroids of the islands of the western Indian Ocean are fairly well known e.g. Aldabra (Sloan, Clark and Taylor 1979), the Seychelles (Möbius 1880, A. M. Clark 1984, Jangoux & Aziz 1984), Maldives (Clark & Davies 1966, Jangoux & Aziz 1984), Mauritius (Möbius 1880, de Loriol 1885), and Réunion (Guille & Ribes 1981).

The echinoderms of Sri Lanka (Ceylon) were described by Döderlein (1889) and H. L. Clark (1915) and of India and adjacent areas by Koehler (1910). The asteroids of the eastern half of Indonesia are also fairly well known (de Loriol 1893, Döderlein 1896, 1917, 1920, 1924, 1935, 1936, Pfeffer 1900, Engel 1938*a* and *b*, Guille & Jangoux 1978, Jangoux 1978, Aziz 1976, 1979).

However the eastern Indian Ocean is less well known; small collections have been described from the Cocos (Keeling) Islands (A. H. Clark 1950) and Christmas Island (Bell 1887, Fisher 1934 and Gibson-Hill 1947) but the Sumatran fauna is poorly known.

The present collection of 53 specimens of 15 species from the Lakshadweep (Laccadive) Islands, Sri Lanka and Pula Wé (Sumatra) will therefore help to fill some of the gaps. The collection includes one new species (*Paraferdina sohariae*) and provides range extensions for *Paraferdina laccadivensis* (from the Laccadives to Sumatra), *Fromia nodosa* (from the Maldives to Sumatra) and *Thromidia seychellesensis* (from the Seychelles to Sumatra).

The collections were made during a voyage across the Indian Ocean from Oman to China. The expedition, *Sindbad Voyage*, was undertaken in 1980–81 using a replica of an ancient Arab sailing vessel, *Sohar*. Details of the holothurian fauna collected during the *Sindbad Voyage* have already been published (Price & Reid 1985).

MATERIALS AND METHODS

Specimens were collected by one of us (A. R. G. P.) and other expedition members at localities from Chetlat island, Lakshadweep (Laccadives), Sri Lanka and Pula Wé (Sumatra). Details of sampling localities are shown in Fig. 1. Sampling was undertaken principally on coral reefs using scuba. At each locality, details of habitat type and depth range were recorded, along with the number of individuals of each asteroid species.

Material was fixed and preserved using standard methods (Lincoln & Sheals, 1979). Specimens were identified by L. M. M. in Perth. The specimens have been divided between the British Museum (Natural History) and the Western Australian Museum (WAM) with a paratype of the new species lodged at the National Museum of Natural History (USNM). An additional specimen of *P. sohariae* from the Phuket Marine Biological Centre (PMBC), Thailand was examined.

SYSTEMATIC ACCOUNT

Throughout this account the synonymy has been confined, where possible, to a single reference from which the original

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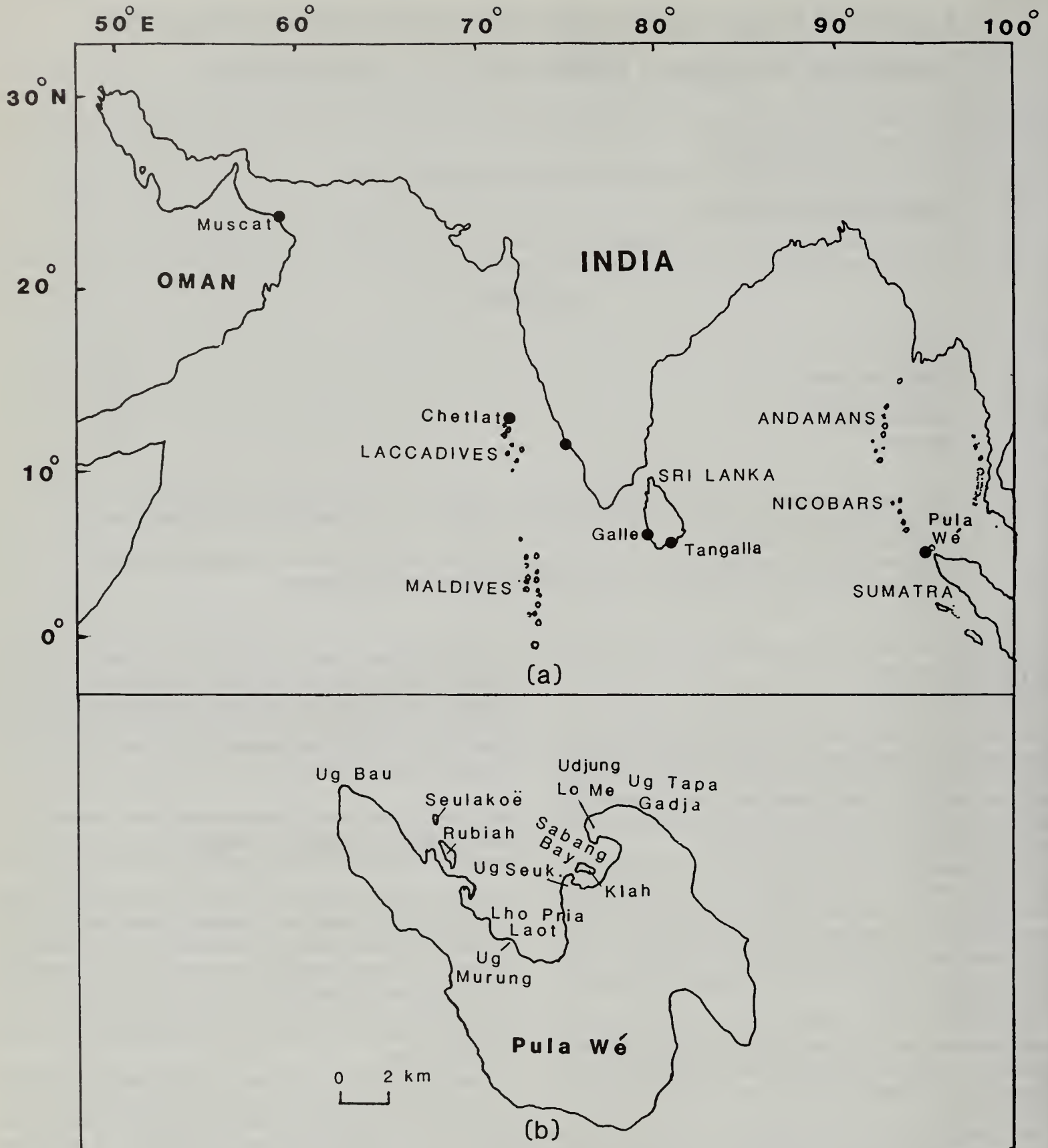


Fig. 1 (A) map of northern Indian Ocean showing sampling areas (●) during *Sindbad Voyage*, with inset (B) for Pula Wé, Sumatra.

description can be traced. Where this is not appropriate the original description is quoted.

ASTEROIDEA
OREASTERIDAE

1. *Culcita novaeguineae* Müller and Troschel, 1842.

SEE. Clark & Rowe, 1971: 34, 54, pl. 7, figs 3–5.

MATERIAL. 810425A/1 (BMNH 1989.11.1.1), 810425D/3, (BMNH 1989.11.1.3), 810424B/2, (BMNH 1989.11.1.2), 810422E/5, (BMNH 1989.11.1.5), 810504C/6, 810428E/4, (BMNH 1989.11.1.4), 810420A/9 (WAM 577–89), 810428E/3 (WAM 578–89).

COLLECTION SITES. Ug Tapa Gadja, Seulakoë, N. Klah I., E. Klah I., S. Klah I., N. Rubiah I., all Pula Wé, Sumatra (8 specimens).

HABITAT AND DEPTH. Rock, coral, sand and gravel, 2–30 m.

REMARKS. The specimens vary from those having numerous pointed tubercles on the reticulum and in the papular areas to one with no tubercles abactinally. All have coarse granules on the actinal surface and a marginal pore-free band. Specimen WAM 577–89 has a few small tubercles in the papular areas while WAM 578–89 has no abactinal tubercles at all. Both approach *C. schmideliana* in having groups of coarse granules, corresponding to the underlying actinal plates, but have small granules amongst the large ones. Their general facies is closer to that of *C. novaeguineae* than to *C. schmideliana*.

2. *Choriaster granulatus* Lütken, 1869

SEE. Clark & Rowe, 1971: 34, 53, frontispiece.

MATERIAL. 810424B/3 (BMNH 1989.11.1.6).

COLLECTION SITE. Seulaköe, Pula Wé, Sumatra (1 specimen).

HABITAT AND DEPTH. Rock, 20–35 m.

OPHIDIASTERIDAE

3. *Linckia guildingi* Gray, 1840

SEE. Clark & Rowe, 1971: 36, 61, fig. 14b, pl. 8, fig. 7.

MATERIAL. 810420A/7 (WAM 574–89) (BMNH 1989.11.1.10).

COLLECTION SITE. S. W. Klah I., Pula Wé, Sumatra (2 specimens).

HABITAT AND DEPTH. Coral reef, 4–5 m.

4. *Linckia laevigata* (Linnaeus, 1758)

SEE. Clark & Rowe, 1971: 36, 62.

MATERIAL. 810420A/6 (BMNH 1989.11.1.11), 810420A/8 (WAM 575–89).

COLLECTION SITE. S. W. Klah I., Pula Wé, Sumatra (2 specimens).

HABITAT AND DEPTH. Coral reef, 4–5 m.

5. *Linckia multifora* (Lamarck, 1816)

SEE. Clark & Rowe, 1971: 36, 62.

MATERIAL. 810124A/2a (WAM 589–89) and (BMNH 1989.11.1.12–15), 810125/B2 (BMNH 1990.4.27.13), 810423A/6 (BMNH 1990.4.27.8–9), 810423B/1 (WAM 580–89) and (BMNH 1990.4.27.5), 810423C/10 (WAM 579–89) and (BMNH 1990.4.27.6–7), 810428A/11 (BMNH 1990.4.27.10–12).

COLLECTION SITE. Ala Gala (Galle), Sri Lanka (7 specimens).

HABITAT AND DEPTH. Rock, 8–15 m.

COLLECTION SITES. Ug Bau, S. Ug Bau, Pula Wé, Sumatra (12 specimens).

HABITAT AND DEPTH. Rock, 20–40 m; coral and sand, 10–20 m.

REMARKS. Several specimens are parasitized by gastropods, *Thyca* sp. (external) and another species (? eulimid) internally.

6. *Fromia indica* (Perrier, 1869)

SEE. Clark & Rowe, 1971: 34, 62.

MATERIAL. 810124A/2G (BMNH 1989.11.1.7).

COLLECTION SITE. Ala Gala (Galle), Sri Lanka (1 specimen).

HABITAT AND DEPTH. On rock, 10–15 m.

7. *Fromia monilis* Perrier, 1875

SEE. Clark & Rowe, 1971: 36, 62.

MATERIAL. 801210B/4 (WAM 590–89) and (BMNH 1990.4.27.18).

COLLECTION SITE. S. end Chetlat, Laccadive Archipelago (2 specimens).

HABITAT AND DEPTH. Coral reef, 18 m.

REMARKS. These specimens differ from *F. nodosa* in having five plates across the base of the ray, between the superomarginals, and in lacking prominent convex carinal plates. The superomarginals are convex but do not encroach on the abactinal surface as much as in *F. nodosa*. R/r of the two specimens is 42/10 mm = 4.2/1.

8. *Fromia nodosa* A. M. Clark, 1967

SEE. A. M. Clark, 1967: 189–191, pl. 6, figs 1–3; Clark & Rowe, 1971: 36, 62, pl. 8, fig. 8.

MATERIAL. 810421A/6 (BMNH 1990.4.27.17), 810424B/1G (BMNH 1989.11.1.9), 810427D/4 (WAM 585–89) and (BMNH 1990.4.27.14–15), 810422E/2G (BMNH 1989.11.1.8), 810425F/6 (BMNH 1990.4.27.16), 810428A/11 (WAM 584–89), 810424C/1 (WAM 587–89), 810422C/2 (WAM 586–89), 810423C/10 (WAM 583–89).

COLLECTION SITES. S. Ug Bau, Ug Bau, N. Klah I., Seulaköe, N. Ujung Lo Me, Ug Seukundo, Ug Murung, all Pula Wé, Sumatra, Indonesia (11 specimens).

HABITAT AND DEPTH. Sand, coral gravel, coral and sand, rock 2–35 m.

REMARKS. The type locality of this species is Amirante Islands, W. Indian Ocean; Clark also records it from the Maldives. The range was extended to the Marshall Is. (W. Pacific) by Oguro & Sasayama (1984), but this is the first record from Indonesia. The specimens have less prominent carinal plates than the holotype but otherwise agree closely. The superomarginals are large and rounded, nearly as broad as long. There are generally only three plates across the base of the ray between the superomarginals. The specimens range in size from R/r of 42/9 mm to 31/7 mm (R/r varies from 4.1 to 5.25/1).

9. *Nardoa frianti* Koehler, 1910

SEE. Koehler, 1910: 158–161, pl. 17, figs 3, 4.

MATERIAL. 810424B/1a (WAM 573.89) and (BMNH 1989.11.1.16).

COLLECTION SITE. Seulaköe, Pula Wé, Sumatra (2 specimens, R/r = 123/12 mm (larger specimen).

HABITAT AND DEPTH. Coral gravel, 20–30 m.

REMARKS. The present specimens agree closely with Koehler's

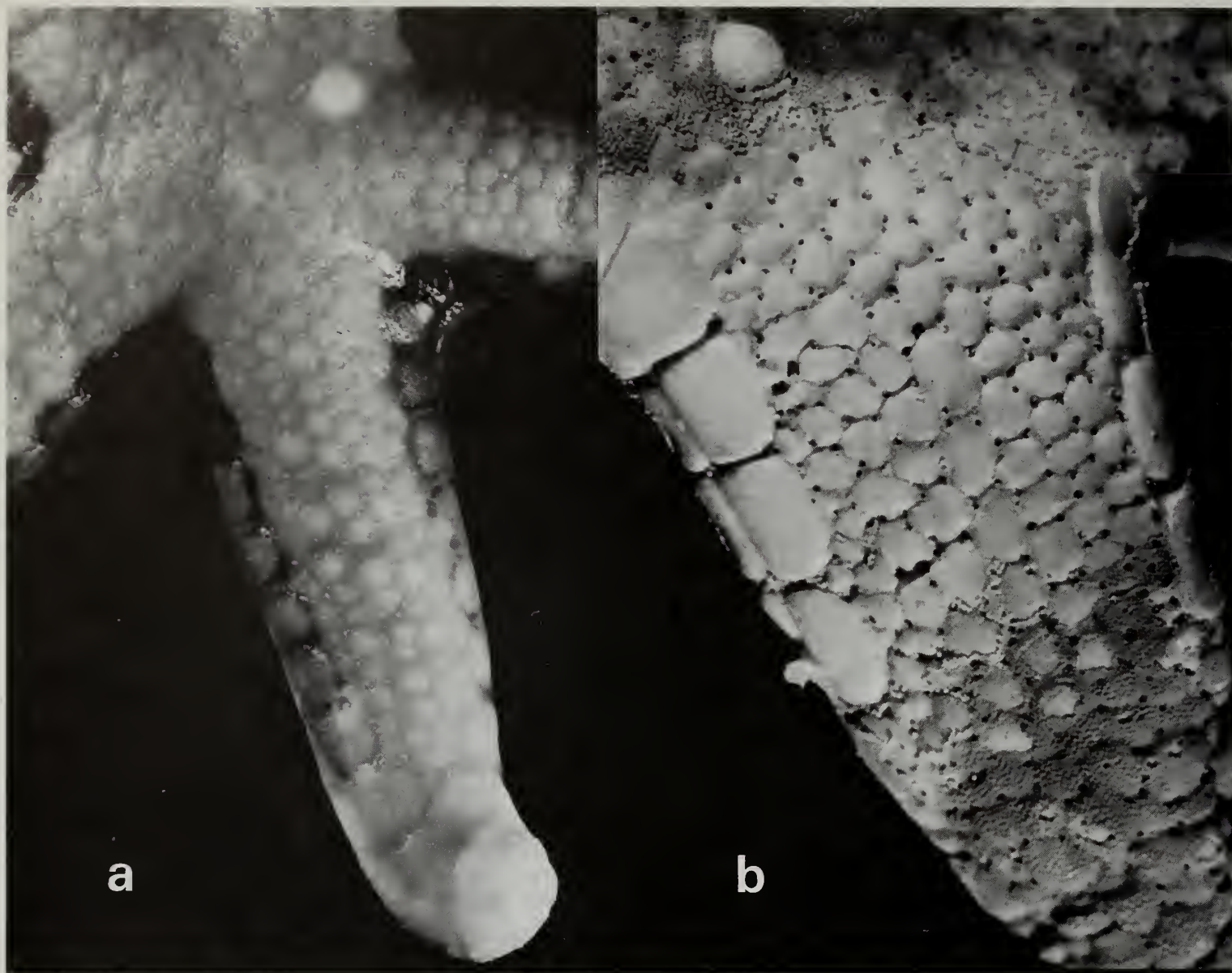


Fig. 2 *Paraferdina laccadivensis*, a, abactinal view (BMNH 1990. 4.27.1, R/r = 36/12 mm); b, abactinal surface, denuded (WAM 77-90, R/r = 33/11 mm).

description and figures. *N. frianti* differs from *N. mamillifera* Livingstone, 1930 principally in the disposition of the actinal plates. In *N. frianti* they are poorly developed and never extend to more than half the arm length. Frequently the series consists of a few plates at the base of the ray with a few more small plates between the large inferomarginals which abut the adambulacrals. If a second series is present at all it consists of a very few plates in the arm angle. In *N. mamillifera* the actinal plates are well developed with two or more rows at the base of the ray. The main series extends to about two thirds of the arm length with plates nearly as large as those of the inferomarginals in some specimens. Both species have alternating large and small superomarginal plates. *N. frianti* and *N. mamillifera* cannot therefore be considered synonymous, as suggested as a possibility by Clark and Rowe (1971).

10. *Nardoa galathea* (Lütken, 1864)

SEE. Clark & Rowe, 1971: 36, 64.

MATERIAL. 810213A/1 (WAM 572-89), 810428B/4 (BMNH 1989.11.1.17).

COLLECTION SITES. Tangalla, Sri Lanka (1 specimen, R/r = 69/

12 mm); S. Ug Bau, Pula Wé, Sumatra (1 specimen, R/r = 140/17 mm).

HABITAT AND DEPTH. On rock, 3-20 m.

REMARKS. The smaller specimen (apart from having six rays) is indistinguishable from individuals from north-western Australia, which have convex abactinal granules, while the large one has much less convex granules, similar to others of comparable size from the Moluccas. Since one of the latter has a regenerating arm with more convex granules, as found in the smaller specimen, it appears that the more convex shape of the granules is a juvenile character.

11. *Neoferdina cumingi* (Gray, 1840)

SEE. Clark & Rowe, 1971: 36, 65; Jangoux, 1973: 786-789.

MATERIAL. 810430A/39 (BMNH 1990.4.1.2), 810504B/3 (WAM 581-89) and (BMNH 1990.4.27.3), 810423C/10 (WAM 582-89), 810422E/2 (BMNH 1990.4.27.4).

COLLECTION SITES. N. Klah, N. Rubiah I., Ug Seukundo, Ug Bau, all Pula Wé, Sumatra, Indonesia (5 specimens).

HABITAT AND DEPTH. Rock, coral and sand, 2-10 m.

***PARAFERDINA* James 1973**

TYPE SPECIES. *Paraferdina laccadivensis* James 1973.

TYPE LOCALITY. Minicoy Island, Lakshadweep (Laccadive) Islands, Indian Ocean.

For the sake of completeness James' (1973) diagnosis of this poorly known genus is repeated here.

DIAGNOSIS. A genus of Ophidiasteridae with polygonal aboral plates, irregular in size with spaces for papular pores; superomarginal plates regular and uniformly covered by granules; actinal plates embedded in tissue; no actinal papulae; a single row of short furrow spines with tips projecting to the outside.

REMARKS. *Paraferdina* differs from *Ferdina* principally in having a regular series of superomarginals and from *Neoferdina* in lacking bare plates.

12. *Paraferdina laccadivensis* James, 1973

SEE. James, 1973: 556–557, pl, 1a.

MATERIAL. 810428A/12 (BMNH 1990.4.27.1), 810423C/10 (WAM 77–90), 810422E/2C (WAM 76–90).

COLLECTION SITES. Ug Bau, S. Ug Bau, N. Klah I., all Pula Wé, Sumatra, Indonesia (3 specimens).

HABITAT AND DEPTH. Mixed coral and sand, 2–8 m; rock 20–30 m.

DIAGNOSIS. A species of *Paraferdina* with short, stout arms, largest known R/r is 42/13 mm, range of R/r ratio 3.0 to 3.2/1; abactinal plates irregular in shape but all of similar size, flat to slightly convex aligned along arms or irregularly arranged, 7–9 across base of ray; carinal series distinct but not prominent; superomarginal plates large, conspicuous from above, squarish to semicircular; actinal plates in 4–5 rows at base of ray; granules on abactinal plates uniform, 9–10/linear mm, on marginals 12/mm and on actinal plates 10–12/mm; abactinal surface uniform light orange, superomarginals magenta, arm tips cream (from one preserved specimen).

DESCRIPTION. (Figs 2, 3) The three specimens have R/r of 42/13, 36/12 and 33/11 mm giving R/r of 3.2 and 3.0/1. The abactinal plates are circular to irregular in shape, 1–2 mm in diameter and are notched for papulae (Figs 2a, b, 3a). They are nearly flat and vary from being aligned along the arm to being irregularly disposed particularly on the outer third of the arms; the carinal row of 18–20 plates is distinct nearly to the arm end; a few plates are slightly more convex than the remainder and in some cases are larger than the lateral plates. At the base of the ray there are 3–4 more or less distinct longitudinal rows of plates on either side of the carinal series decreasing to two distally and becoming more irregular in arrangement. On one specimen slightly raised plates form up to five indistinct rows across the arms. The terminal plate is rounded, 1.5 to 1.8 mm in diameter.

The superomarginal plates are large, conspicuous when viewed from above (Figs 2b, 3a) and number 10–11 (the third from the arm angle measures 3.0 to 3.5 mm long by 2 to 3 mm broad) and are regularly arranged except sometimes near the arm end, they vary from more or less square to rectangular and D shaped; the last superomarginals meet across the upper surface of the arm. The inferomarginals number 12–16, the smaller number when they match the superomarginals, the

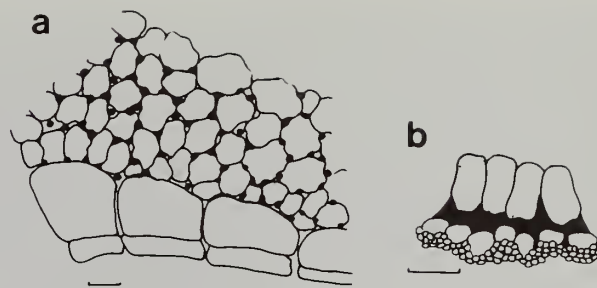


Fig. 3 *P. laccadivensis*, a, base of arm, denuded, carinal series at top, first superomarginal on left (WAM 77–90); b, ambulacral furrow, showing outer, granule covered face and inner surface of furrow spines (WAM 77–90). (Scale bar = 1 mm.)

larger when the plates become smaller and less regular near the arm end. The actinal plates are in four rows at the base of the rays except in the largest specimen where there are 2–3 plates of a fifth row.

The abactinal plates are covered by close packed, convex, polygonal granules (9–10/linear mm) except near the arm ends where they are coarser and irregular in size (5–7/mm). In the largest specimen the granules surrounding the papular pores are slightly elongate. The marginal plates have a finer granulation (12 granules/mm) while the actinal plates have 10–12 granules/mm. The adambulacral armature is limited to a single row of paired furrow spines, which are stout, blunt ended, equal to subequal in size (in one specimen measuring 0.8 by 0.5 mm) but somewhat irregular in size and shape. The actinal granulation conceals all but the tips of the furrow spines (Fig. 3b).

The papulae are generally single with 6 equally spaced around a hexagonal carinal plate; however, where the plates are less regular, papulae occur in groups of two or three and there may be up to 14 around one plate.

The colour of one specimen (preserved in Steedman's solution) is striking, the abactinal surface is light orange bordered by bright magenta superomarginals except for the arm tips which are cream. The inferomarginals and actinal areas are paler, shading to cream at the furrow; the arm ends and madreporite are cream. One dry specimen has the abactinal surface burnt orange, including the arm tips, with the marginals and actinal surface faded magenta, the largest specimen (dry) has the abactinal surface faded to deep cream; magenta is still evident on the marginals and actinal surface but the colour does not extend to the arm ends.

REMARKS. The present specimens, in excellent condition, allow further descriptive details and variation of the species to be noted. The R/r ratio differs from that of the holotype which had R.r of 35/14 mm (2.5/1) (James 1973). The illustration of the holotype, however, indicates longer arms relative to r despite damage to the arm ends. Since it would have been difficult to estimate R accurately the difference in R/r ratio from the present specimens is not regarded as significant.

The major difference is in the number of superomarginal plates (15 in the holotype but no more than 12 in the present specimens) and in their shape (the holotype has the superomarginals broader than long while the Sindbad specimens have them as long as broad or longer).

In other respects these specimens closely resemble the holotype. Unfortunately direct comparison with the holotype could not be made and the Sindbad specimens are referred to this species with a little hesitation.

The colour is described for the first time.

We agree with James (1973) that this species belongs in a genus between *Ferdina* and *Neoferdina* and consider it to be more closely related to the latter because of the plate arrangement and prominent (but not bare) superomarginal plates.

13. *Paraferdina sohariae* sp. nov.

Ferdina offreti: (pt.) Koehler, 1910: 143, 147, pl. 16, Figs 4, 5.

HOLOTYPE. 810125A/1 (WAM 78-90).

TYPE LOCALITY. Deumba Gala, Galle, Sri Lanka, on rock 12-15 m.

MATERIAL. 810125A/1 four paratypes (WAM 79-90, BMNH 1990.4.4.2-3, USNM E40225) same data as holotype; PMBC 3048, Similan I., Andaman Sea, coral reef, 14 m, 12 Feb. 1979.

HABITAT AND DEPTH. Rock, 12-15 m; 62 m (Koehler, 1910).

DIAGNOSIS. A species of *Paraferdina* with somewhat flattened, tapering arms, largest known R/r is 50/15 mm, range of R/r ratio 3.3 to 4.3/1; abactinal plates markedly variable in shape, size and convexity, 5-7 across base of ray; usually a prominent carinal series of elevated, slightly convex plates sometimes alternating with smaller convex or flat plates; usually smaller flat plates among the larger ones on disc or arms; superomarginal plates large, conspicuous from above, D-shaped; actinal plates in 4-5 rows at base of rays; granules on abactinal plates very variable, from 5-6 to 9-10/linear mm on convex plates, 12/mm on interstitial and flat plates, 9-12/mm on actinal plates; granulation is coarser near arm ends than proximally; 1-5 enlarged granules sometimes present on convex abactinal plates; colour in life unknown, preserved specimens have buff or yellow-brown granules on the convex plates contrasting with orange to deep rose-red granules on the interstitial and flat plates.

DESCRIPTION OF HOLOTYPE. (Figs 4, 6) Rays 5, tapering, R/r = 40/11 mm, = (3.6/1), br = 11.5 mm. The abactinal surface of the disc and rays is convex, with convex, rounded to polygonal, granule covered abactinal plates and large superomarginals (Fig. 4a, b). There are 22-23 carinal plates; on the outer two thirds of the ray prominent convex carinals alternate irregularly with smaller flat plates. At the base of the ray there are five to seven plates across the arm, two or three each side of the carinal series, by about half the arm length this is reduced to one each side of the carinal series. The abactinal plates are irregular in shape and size, 0.8-2.7 mm diameter, close fitting and slightly notched for the papulae. On the disc there are five prominent primary interradiial plates (including the madreporite) and a prominent radial plate at the beginning of each carinal series. The remainder of the disc is covered by smaller, irregularly arranged plates.

The madreporite is small, rounded triangular, convex, situated interradially, half way between the anus and the margin.

The superomarginals number 12-13, the first pair are wider than long (3 × 2 mm) but the remainder are about as wide as long except distally where they are again wider than long. They are prominent, more or less semicircular and gradually decrease in size distally, the last 2-4 meet mid radially. The inferomarginals number 15 and are aligned with the superomarginals except at the arm tips; they are longer than wide (3 × 1.5 mm) except for the first one which is square.

The actinal plates are in 4 rows proximally, (Fig. 4c), with a few plates of a 5th row in some arm angles. The innermost row extends nearly to the arm end (to the 11th or 12th inferomarginal), the second row extends to the 9th or 10th inferomarginal, the third row to the 6th or 7th inferomarginal and the fourth to the 3rd or 4th inferomarginal.

There is a single row of adambulacral spines along the furrow margin, only the tips of which project above the adjacent granules. The furrow spines are subequal, truncate, 1.05 mm long, two or occasionally three per plate (Fig. 6a). The four oral spines are undifferentiated from the furrow series.

The entire surface is granule covered; the abactinal convex plates are more coarsely granulated (9-10/linear mm) than the smaller plates and the marginals (12/mm). In addition some of the convex plates bear 1-5 enlarged tubercle-like granules (Fig. 6b). Near the arm ends the granulation of abactinal, terminal and marginal plates is very coarse (6-7/mm). The actinal plates have 10-12 granules/mm.

The papulae occur singly, occasionally in groups of 2, not in regular rows but around the plates e.g. there are 6-8 around a carinal plate. There are no actinal or intermarginal papulae. Pedicellariae are absent.

Colour (in alcohol). The granules covering the raised abactinal plates, marginals and actinal plates are buff, those covering the flat plates and grooves between the marginal and actinal plates are orange.

OTHER MATERIAL. The four paratypes show considerable variability in the R/r ratio and in the number and disposition of convex abactinal plates giving a very different appearance. The colour pattern is constant but the shade of orange is darker in some.

Paratype WAM 79-90 (Fig. 5a) has R/r of 36/11 mm (3.3/1). The carinal plates do not form a regular series on all the arms, fewer of them alternate with smaller plates than in the holotype and there are more large convex plates (Fig. 6c); the arm plates are from 1-3 mm in diameter with coarse granulation on the larger plates (7-8/linear mm), finer on the smaller abactinal plates and on the actinals (10-11/mm); there are 5 plates across the base of the ray; 10-11 superomarginals and 13-15 inferomarginals. The actinal plates are in 4 rows with a few extra plates in the arm angle; the third row extends to the 5th or 6th inferomarginal, the fourth to the third inferomarginal.

Paratype BMNH 1990.4.4.2 (Fig. 4d) has R/r of 37/10 (3.7/1). The carinal series is irregular except near the end of the arms and the abactinal surface is covered by large convex plates. On the proximal half of the arm there are three irregular rows with a small plate either side on some rays. There are 13 superomarginals and 15-16 inferomarginals. The actinal plates are in 3 rows proximally, with a few plates of a 4th row.

Paratype BMNH 1990.4.4.3 is an irregular specimen with three arms regenerating. R/r = 38/10 mm (3.8/1). The abactinal plates are very irregularly arranged and the carinal series is only evident on one ray.

Paratype USNM E40225 (Fig. 5b) has R/r of 43/10 (4.3/1). The carinal series is only regular on one ray where large and small plates alternate distally. There are 5 plates across the base of the ray; 12-13 superomarginals and 16 inferomarginals. The actinal plates are in 4 rows proximally. The granulation is much coarser than on the holotype with 5-6 granules/mm on

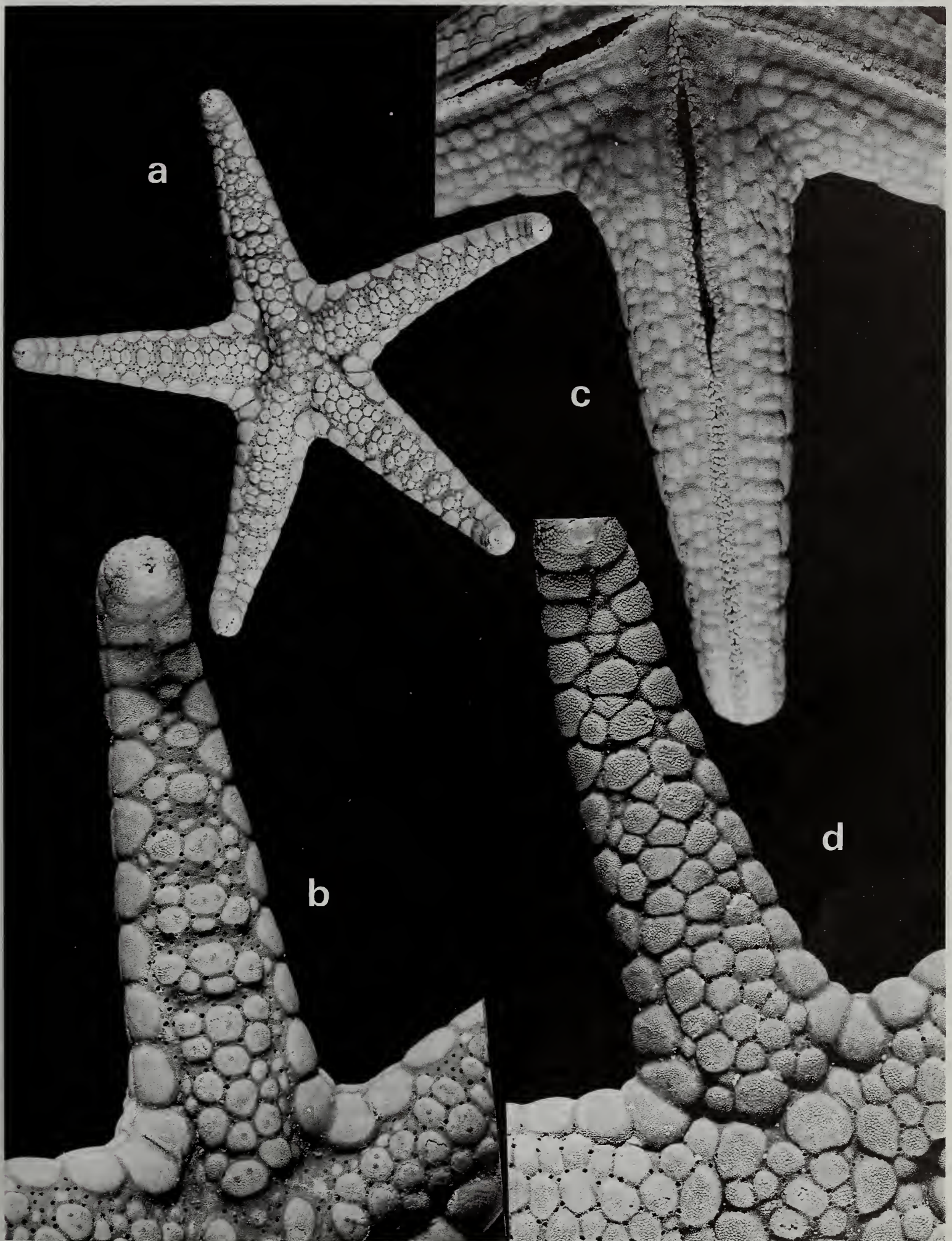


Fig. 4 *Paraferdina sohariae* n. sp. a, b, abactinal views of holotype (WAM 78-90, R/r = 40/11 mm); c, actinal view of holotype; d, abactinal view of paratype (BMNH 1990.4.4.2, R/r = 37/10 mm).

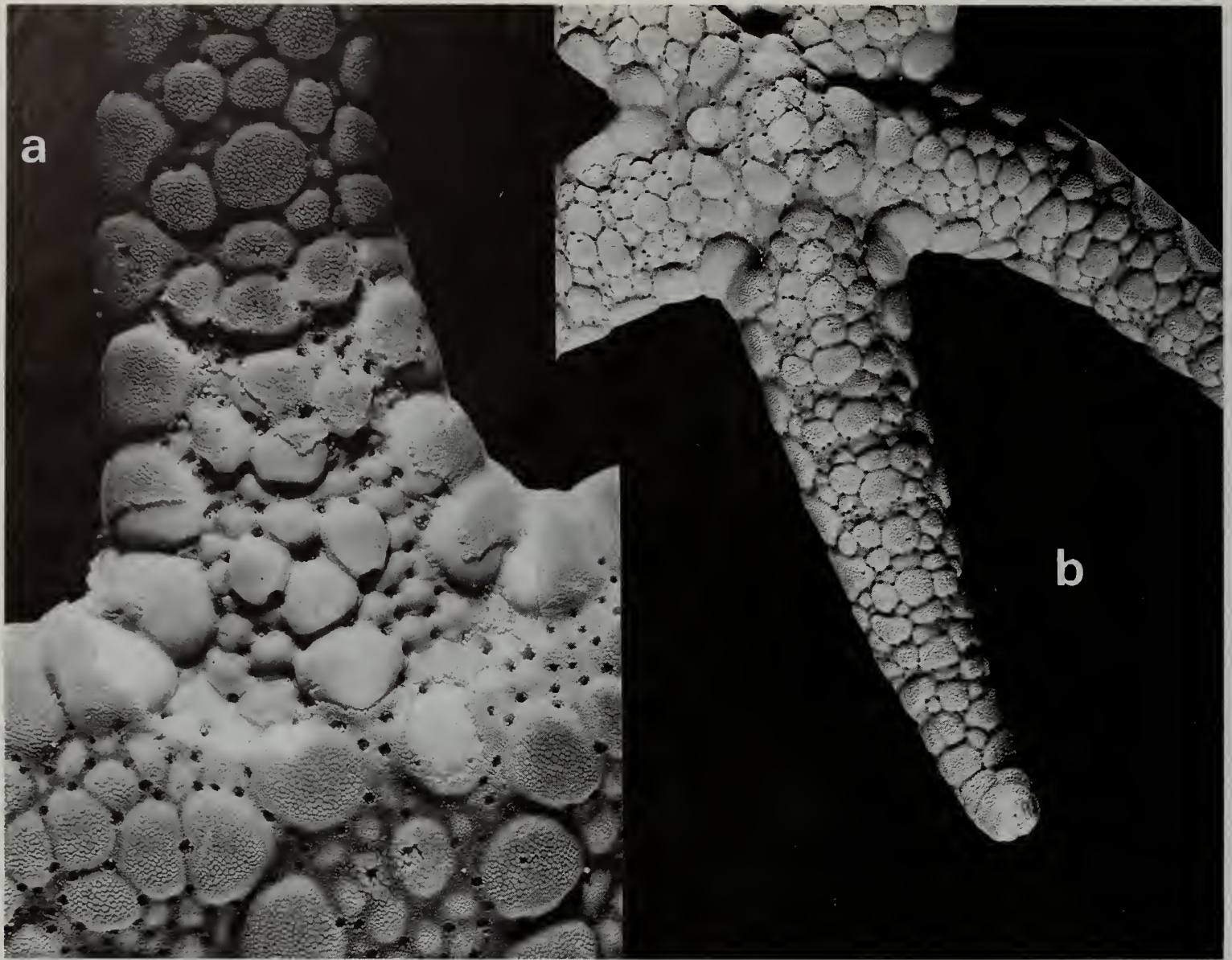


Fig. 5 *P. sohariae* n. sp. a, abactinal view of paratype, arm partly denuded (WAM 79-90, R/r = 36/11 mm); b, abactinal view of paratype (USNM E40225, R/r = 43/10 mm).

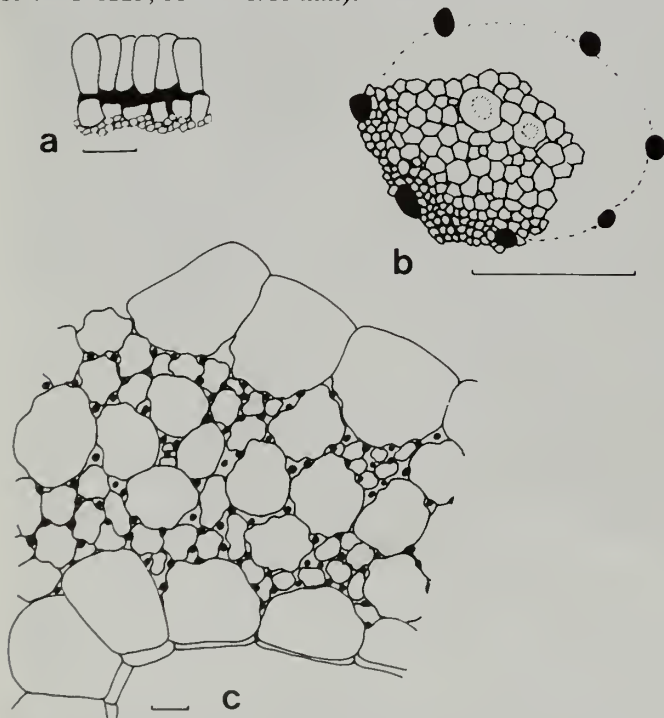


Fig. 6 *P. sohariae* n. sp. a, ambulacral furrow, showing outer granule covered face and inner surface of furrow spines (holotype, WAM 78-90); b, granulation of an abactinal plate with two tubercular granules (holotype); c, base of arm denuded (paratype WAM 79-90). (Scale bar=1 mm).

the abactinal and marginal plates with a few tuberculate granules and 9-10/mm on the actinal plates.

Only two of the paratypes have any tubercle-like granules on the abactinal plates and these are fewer than in the holotype.

PMBC 3048 (Fig. 7) has R/r of c. 50/15 mm (3.3/1). The R value is approximate because of damage to the arm ends. The carinal plates are enlarged, convex, alternating irregularly with smaller, flat plates. There are five plates across the base of the ray, distally three; 14 supermarginals and about the same number of infero-marginals, distally the last 2-3 supermarginals meet across the ray.

The actinal plates are in three rows with a fourth in the arm angle, the third row extends to the fifth or sixth inferomarginal, the fourth row to the second or third inferomarginal.

The whole of the abactinal and actinal surfaces are covered by a uniform coat of fine granules, 11/linear mm.

A colour slide of the dried specimen, photographed in 1982, shows the convex abactinal plates and marginals as light yellow brown; the disc, some small plates and grooves between the convex plates and marginals were deep rose-red while the actinal plates were cream to pink outlined in old rose, yellowish at the arm ends; the furrow spines were

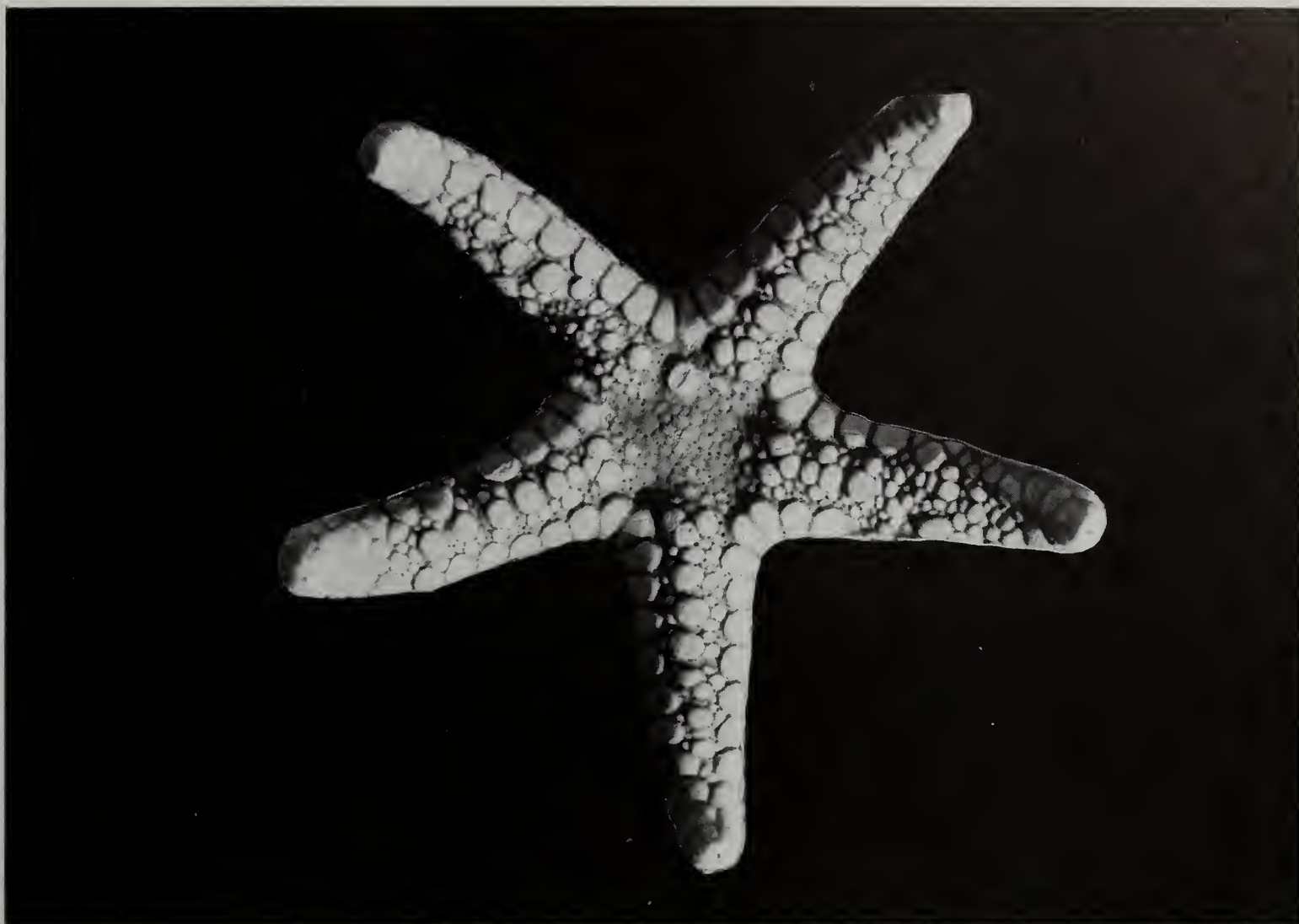


Fig. 7 *P. sohariae*, dried (PMBC 3048, R/r = 50/15 mm).

cream. This example differs from the Sindbad specimens in its larger size, lack of convex plates on the disc and uniform granulation of the plates. However, in view of the variability shown by the five specimens from Sri Lanka the differences are outweighed by the similarities and we consider that this specimen also represents *Paraferdina sohariae*.

A small specimen from Ceylon (Sri Lanka), with R of 13.5 mm, referred to as a juvenile *Ferdina offreti* by Koehler (1910) and believed to represent *Fromia nodosa* by A. M. Clark (1967) cannot be placed in *Fromia* because of the adambulacral armature. Koehler included it in *Ferdina* as it had a single row of spines on the adambulacral plates but noted that the marginal plates were granule covered, unlike those of the holotype. This specimen is now referred to *Paraferdina* and clearly represents *P. sohariae*.

RANGE OF VARIATION. The size (R) ranges from 36 to 50 mm with an R/r ratio of 3.3 to 4.3/1 (mean 3.7/1). They have five to seven plates across the base of the rays between the supermarginals, however there is considerable variation in the relative numbers of convex and flat plates. There are 14 supermarginals in the Thai specimen, 12-13 in three specimens, 10-11 in one and those of the remaining specimen are too irregular to count. Inferomarginals number 15-16 in three specimens. 13-15 in another. The abactinal plates are coarsely granulated with 9-10 granules/linear mm, while the marginals have 12/mm except near the arm ends where abactinal, terminal and marginal plates have very coarse

granulation (6-7/mm). Actinal plates have 10-12 granules/mm in the holotype, 9-10/mm in one of the paratypes. Three of the paratypes have slightly coarser granulation than the holotype while one has a much coarser granule cover. The Thai specimen has a uniformly fine granule cover with 11/linear mm.

ETYMOLOGY. Named after the expedition ship, *Sohar*.

REMARKS. This species clearly belongs in the genus *Paraferdina* since it has conspicuous granule covered marginal plates, polygonal abactinal plates, irregular in size, no actinal papulae and a single row of furrow spines. *P. sohariae* differs from *P. laccadivensis* in having more tapering rays, more convex abactinal plates which are very variable in size and up to 3 mm in diameter. The differences are emphasised by the distinctive colour pattern of each species.

DISTRIBUTION. This species is known from only two localities—the type locality (Sri Lanka) and Similan I., Andaman Sea.

MITHRODIIDAE

14. *Thromidia seychellesensis* Pope & Rowe, 1977.

SEE. Pope & Rowe, 1977: 207-210, figs 7, 8, 11.

MATERIAL. 810504D/1 (WAM 576-89).

COLLECTION SITE. N. W. Klah I., Pula Wé, Sumatra (1 specimen).

HABITAT AND DEPTH. Coral rubble, 10 m.

REMARKS. The specimen is badly distorted but $R/r = c. 170/50$ mm (3.4/1) compared to the holotype and paratype which have R/r of 124/22.5 mm (5.5/1) and 135/27.5 mm (4.9/1) respectively. Papular areas are 2–4 mm in diameter with 20–100 pores on the disc and arm bases, decreasing to single pores near the arm ends. On the distal fifth of the arms, convex, granule covered plates form a cobbled pavement as described by Pope and Rowe. The granulation is as described for the holotype.

The present specimen with R 45 to 35 mm longer than the holotype and paratype confirms Pope and Rowe's (1977) suggestion that their specimens were not fully grown. This is the first record of this species outside the Seychelles Islands and extends the range of the species from the western Indian Ocean to the eastern Indian Ocean.

ACANTHASTERIDAE

15. *Acanthaster planci* (Linnaeus, 1758)

SEE. Clark & Rowe, 1971: 38, 71, pl. 11, fig. 3.

MATERIAL. 810424E/1 (WAM 588–89), 810425G/1 (BMNH 1989.11.1.18).

COLLECTION SITES. Nr Rubiah I., Pula Wé, Sumatra (1 specimen $R/r = c. 150/70$ mm); W. Rubiah I., Pula Wé, Sumatra (1 specimen, $R/r = c. 130/70$ mm).

HABITAT AND DEPTH. Coral, 1.5–6 m.

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